SIR EDWARD APPLETON

PHYSICIST AND PIONEER OF IONOSPHERE RESEARCH

Sir Edward Appleton, G.B.E., K.C.B., F.R.S., who died on Wednesday, had been Principal and Vice-Chancellor of Edinburgh University for nearly 16 years, and was one of the foremost physicists of his time. He won this position by his pioneering investigations into the electrical properties of the upper atmosphere, one result of which was the discovery of the electrified sheet which is known as the Appleton layer.

In 1901, when Marconi first transmitted wireless messages across the Atlantic, the fact that communication could be established between England and America caused much astonishment, since there seemed to be no adequate reason why the waves should bend round and follow the curvature of the earth to the extent necessary. In 1902 Oliver Heaviside and A. E. Kennelly independently suggested that a high layer of air endowed with the power of conducting electricity would act as a mirror for wireless waves and prevent them escaping, but for many years this was an unsupported speculation. It was Appleton who initiated and carried through a striking series of experiments which demonstrated the real existence of such conducting layers of ionized air and who followed this up by prolonged investigations into the structure and properties of this electrified region, now known as the ionosphere.

WIRELESS WAVES

The First World War, in which he had served as a junior officer in the Royal Engineers, had made Appleton familiar with the generation and detection of wireless waves by the technique involving thermionic valves, then just being introduced, and soon after that war, when he was still in his early twenties, he began an extensive series of experiments in which he showed how these waves could be used for exploring the electrical state of the upper atmosphere. It was in 1925 that, with his student M. A. F. Barnett, he obtained interferences between waves passing along the ground and waves reflected from above, which proved the existence of the reflecting layer and enabled its height to be found. He then worked out the conditions which determined whether waves should be reflected from a layer of electrified particles in the upper atmosphere or should penetrate the layer and be lost in space, showing that the behaviour depended upon the nature and the number of particles and upon the frequency of the waves and also predicting the influence of the earth's magnetic field on the phenomena.

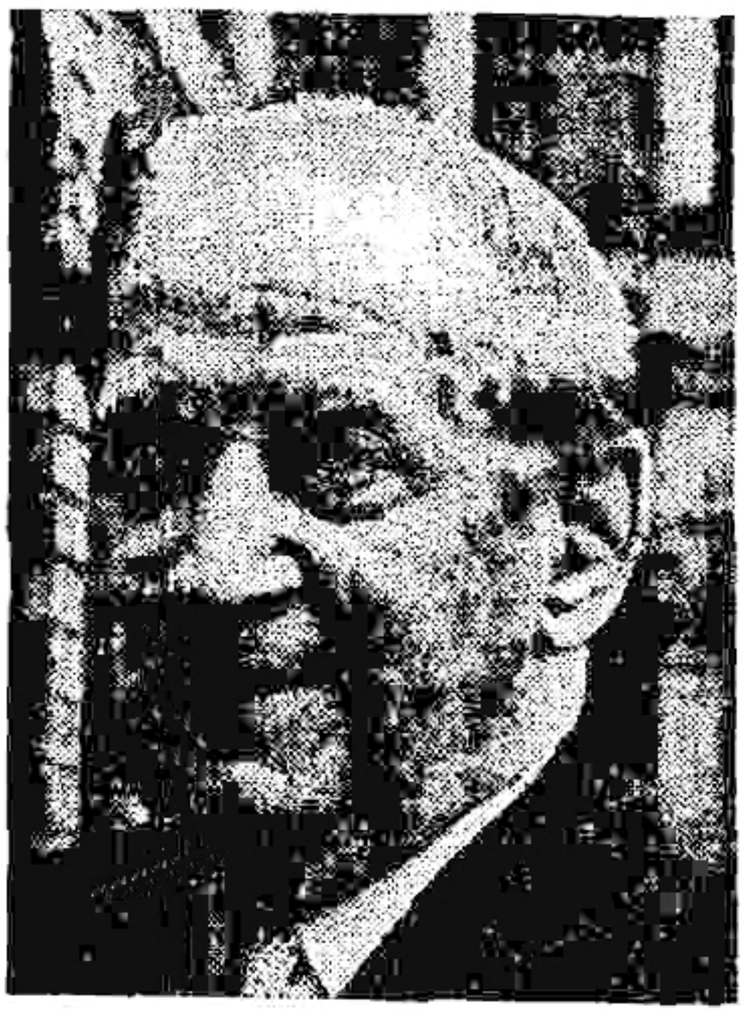
SUN SPOT ACTIVITY

With the aid of this theoretical knowledge he established experimentally the existence of a second layer (which was called after him), proved that the electrified particles responsible for the reflection were electrons and showed how to measure the number of electrons in a given volume. This led in 1931 to systematic work on the variation of the number of electrons present at different heights at different times of the day and at different seasons: Appleton thus inaugurated the continuous study of the electrical state of the upper atmosphere which is today carried on at a large number of stations spread all over the world. The layer structure of the ionosphere was also further analysed by Appleton and he showed the existence of lunar tides in it.

One of his most interesting findings was that the ionization in the upper layer was due to ultra-violet light from the sun; this went hand in hand with his discovery of the connexion between sun spot activity and ionization. He was also active in investigating wireless waves sent out by the sun itself.

The methods which Appleton initiated and the results which his keen physical insight won from them were not only of theoretical interest but also of great practical importance. They enable us to forecast what the conditions of reflection for wireless waves will be at different times of the day and at different seasons, and thus to predict the most suitable wavelengths to use. More important still it was Appleton's work that really led to the use of radar for locating distant aircraft, for the detection of wireless waves reflected from aircraft was first carried out by methods which he had devised for the detection of waves reflected from the ionosphere. Appleton's work on the ionosphere brought him many scientific distinctions, including the Hughes Medal of the Royal Society in 1933, a Royal Medal of the Royal Society in 1950, and the award of the Nobel Prize for Physics in 1947. He received honorary degrees from many British and North American universities.

Appleton was also a very successful administrator. In 1939 he was appointed to the secretaryship, which is the directing



post, of the Department of Scientific and Industrial Research and carried the burden of this responsible position throughout the Second World War, being prominently concerned with the organization of the development of radar and with the secret work on the atomic bomb, among many other matters. After the war he was actively associated with the development of technological research and in this capacity carried the confidence of his scientific colleagues, of industry and of the Government alike.

Edward Victor Appleton was born on September 6, 1892, at Bradford, Yorkshire, into a modest Wesleyan household. He always maintained an active affection for his native town. His family supported the ambitions for a scientific career which showed themselves towards the end of his school career, and in 1911 he entered with a scholarship St. John's College, Cambridge, of which he later became an honorary fellow. A brilliant university career, in which he achieved distinction in mineralogy, was interrupted by the 1914-18 War, after which he returned to Cambridge and began, while acting as assistant demonstrator in the famous Cavendish laboratory, the researches to which reference has already been made. At the age of 32 he had already made sufficient of a name in physics for him to be appointed as Wheatstone Professor of Physics at King's College London, where he remained for 12 years, a period during which some of his best research was carried out. In 1936 he was appointed to the Jacksonian Professorship at Cambridge as successor to the famous C. T. R. Wilson.

ACADEMIC WORLD

In 1949 Appleton returned to the academic world as Principal and Vice-Chancellor of the University of Edinburgh, a very demanding and distinguished post. He had many of the qualities necessary for success—intellectual stature, vast administrative experience, a strong determination and an eagerness to look to the future. There was no danger of a stagnant university under his guidance.

He presided over one of the largest building programmes in the history of the university. It was his misfortune that the most spectacular scheme, the George Square development, was bound to provoke controversy to the point of bitterness. There was never much chance that a square which was a unique example of one stage in the history of Edinburgh could be so substantially changed without loud protest. But the scheme was not of Appleton's authorship. Plans for the redevelopment of George Square existed some years before he went to Edinburgh. What he did was to obtain action, in spite of all opposition, on a specific project.

This incident was typical of much in Appleton's rule in Edinburgh. He could override opposition, but all too rarely could he mollify it. No doubt much of the criticism must have seemed merely destructive to a Principal who, with the responsibility of planning for expansion, could not let his policy be dictated by an impractical nostalgia. There were occasional difficulties. They are bound to occur in such a post.

CONTACT WITH STUDENTS

Sometimes his fault was more one of personal presentation than of policy. His forthright influence and mental stimulus were highly beneficial, however, among those in Edinburgh with whom he came in close contact—and he did what he could to make sure that he was in touch with as many as possible, staff and students. In this as in every other aspect of his responsibilities he was immensely conscientious. He had the dignity, the authority and the gift of expression necessary for formal occasions. But his concern went far beyond that. His enthusiasm for the development of science was more than a personal predilection: it was an example of his determination that the university should be equipped to play its full part in the modern world.

Appleton combined a profound and penetrating genius for physical research with unusual administrative ability and great natural shrewdness in all practical matters. He had in him a great appreciation of intellectual values, which made him a popular figure in academic circles, combined with a certain Yorkshire homeliness which enabled him to mix freely with the class of people who like to call themselves plain men. He made good friends and he retained them. He was a brilliant lecturer, both to general and to expert audiences, and everything that he wrote was distinguished by clarity and decision.

Early in life, in 1915, he married Jessie, daughter of the Rev. J. Longson. There were two daughters of the marriage. His wife died in 1964. He married secondly, last month, Mrs. Helen F. Allison, who had been his private secretary for some years.